

INK JET RECORDING APPARATUS AND RECOVERY MECHANISM  
PORTION OF INK JET RECORDING APPARATUS

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to an ink jet recording apparatus for performing recording by discharging ink from recording means to a recording material, and relates to a recovery mechanism portion  
10 of the recording apparatus.

Description of Related Art

A recording apparatus having a function of a printer, a copying machine, a facsimile or the like, or a recording apparatus which is used as an output  
15 equipment of a compound type electronic instrument or work station including a computer, a word processor and the like, is configured to record images (including letters, marks and the like) on recording materials (recording media) such as paper, cloth,  
20 plastic sheets, sheets for an overhead projector (OHP), or the like on the basis of recording information. In a serial type recording apparatus, which performs recording while executing main scanning in a direction crossing with the conveyance  
25 direction of a recording medium, images are recorded with a recording head (recording means) mounted on a carriage moving along the recording medium. Having

finished recording of one line, the serial type recording apparatus performs paper feeding for a predetermined pitch. After the paper feeding, the serial type recording apparatus executes the

5 recording of the images of the next line to the recording material, which has stopped again after the paper feeding. The serial type recording apparatus performs the recording to the whole recording medium by repeating the above-mentioned recording operation.

10 On the other hand, in a line type recording apparatus, which performs recording only in the conveyance direction of a recording material, the recording material is set at a predetermined position, and the recording of a line is performed in the lump. After

15 that, paper feeding for a predetermined pitch is performed, and the recording of the next line is performed in the lump. The line type recording apparatus repeats the above-mentioned recording operation to perform the recording of the whole

20 recording material.

Among the above-mentioned recording apparatuses, an ink jet recording apparatus, which performs recording by discharging ink from a recording head to a recording material, can easily miniaturize

25 recording means, and can record highly fine images at a high speed. Furthermore, the ink jet recording apparatus can perform recording on a sheet of plain

paper without special processing. Moreover, the running cost of the ink jet recording apparatus is inexpensive, and the noises of the ink jet recording apparatus is little since the ink jet recording apparatus adopts a nonimpact system. Besides, the ink jet recording apparatus can easily record color images by the use of many kinds of inks (for example, color inks). The ink jet recording apparatus has the advantages described above. Moreover, demands for the quality of the recording materials used in the ink jet recording apparatus are various, and recently development meeting these demands has made progress. In addition to ordinary recording paper, a resin thin plate (for an OHP and the like), and the like, cloth, leather, nonwoven fabric, metal and the like has begun to be used.

In the ink jet recording apparatus, recording is performed by discharging ink from fine discharge ports. Consequently, when ink is increased in viscosity or fixed due to evaporation of ink (evaporation of a solvent) in the vicinity of the discharge ports, or when ink or dust such as paper powder is attached on an discharge port surface, or further when bubbles invade ink in the discharge ports, not only the discharging of ink becomes unstable, but also bad discharges such as kinks of discharged ink, undischarged states of ink and the

like are sometimes produced.

Accordingly, a recovery mechanism portion for keeping and recovering the ink discharge performance of a recording head as recording means in a good  
5 state is provided. As recovery means in the recovery mechanism portion, there are wiping means, capping means, sucking means and the like. The wiping means wipes an discharge port surface to clean it (wiping cleaning) by sliding a wiper made of an elastic  
10 member such as rubber or the like on the discharge port surface to rub the discharge port surface for cleaning the discharge port surface by removing unnecessary ink attached to the ink discharge port surface due to ink mist or rebounds of ink drops from  
15 a recording material and foreign matter such as paper powder attached to the ink discharge port surface during recording operations.

When ink has not been discharged for a long time from a recording head, the ink in discharge  
20 ports sometimes evaporated and dried, and the discharge ports are plugged up. Consequently, bad discharging such as unstable discharging, undischarged states or the like is sometimes caused about. The capping means caps (closes up tightly)  
25 the discharge port surface of a recording head during the time when recording is not performed to reduce or to prevent the increase in viscosity or the fixing of

ink owing to the evaporation and the drying of the ink in the discharge ports of the recording head. Moreover, when air bubbles invade the recording head, or when the ink discharge ports are clogged owing to the increase in viscosity or the fixing of the ink which attached to the ink discharge port surface to dry, the sucking means produces a negative pressure in the cap with a suction pump communicating with the cap in the state in which the discharge port surface of the recording head is shut tightly with the cap. Thereby, the sucking means exhausts the ink discharge ports and exchanges the ink in the ink discharge ports with normal ink to keep and to recover normal ink discharging.

As the configuration of the wiping means, the configuration of performing wiping and cleaning with a wiper made of rubber-like elastic member moving in the arrangement direction of the ink discharge ports of the recording head is frequently adopted. Moreover, from the point of view of preventing the increase of the apparatus width size of a recording apparatus, the cap and the wiper are configured so as to overlap each other, so that the wiper passes between the cap and the discharge port surface when the cap is separated from the discharge port surface. Moreover, as one of the driving methods of the cap, the method of making the cap approach or recede

against the discharge port surface by means of a lever or the like which is driven to rotate with a cam member for cap control is adopted. Moreover, as one of the driving methods of the wiper, the method  
5 of moving the wiper in rectilinear reciprocating directions (for example, front and rear directions) with a cam, a rack and pinion, a lead screw, or the like is adopted. Thus, the wiper is configured to pass between the cap and the discharge port surface  
10 when the cap is separated from the discharge port surface. In this case, the wiper is frequently moved from an upper stream side to a down stream side along a discharge port train while the wiper is made to slide to rub the discharge port surface to wipe the  
15 discharge port surface to clean it.

However, in the recovery mechanism portion including the wiping means of the system of driving the wiper with the cam, the rack and pinion, or a mechanism formed by combining them, a larger cam  
20 member or a longer rack member becomes necessary as the movement distance of the wiper becomes longer owing to the increase of the area of the discharge port surface. Consequently, the apparatus body becomes larger, which in turn makes it difficult to  
25 implement the miniaturization of the recording apparatus. Moreover, in the recovery mechanism portion including the wiping means of the system of

driving the wiper by the use of the lead screw, it becomes necessary to form an approach section of a predetermined distance from a starting position of the operation of the wiper lest the wiper should  
5 overlap the cap until the cap is sufficiently separated from the discharge port surface.

However, if the approach section is formed to be sufficiently long, the size of the recording apparatus body in the front and rear direction  
10 increases to make it difficult to miniaturize the recovery mechanism portion or the recording apparatus. Even if the pitch of the lead screw in the approach section is changed, the wiper moves within the approach section. Consequently, the size of the  
15 recording apparatus body in the front and rear direction becomes larger by the movement distance.

#### SUMMARY OF THE INVENTION

An object of the present invention is to  
20 provide an ink jet recording apparatus capable of miniaturizing a recovery mechanism portion for keeping and recovering the ink discharging performance of recording means, and thereby capable of realizing the miniaturization of the recording  
25 apparatus body, and to provide the recovery mechanism portion of the recording apparatus.

The present invention is an ink jet recording

apparatus for performing recording by discharging ink from recording means to a recording material, the apparatus including a cap capable of moving in approaching and receding directions against a discharge port surface of the recording means for covering the discharge port surface, a wiper sliding while contacting with the discharge port surface to wipe the discharge port surface to clean it, a wiper driving gear for transferring drive to the wiper, a cam and gear member equipped with a cam portion for controlling movement of the cap and a gear portion for transferring drive to the wiper driving gear, in which the cam and gear member is configured so that the gear portion engages with the wiper driving gear after the cap has moved to a position where the cap does not interfere with the wiper.

According to the present invention, since in an ink jet recording apparatus for performing recording by discharging ink from recording means to a recording material, the apparatus includes a cap capable of moving in approaching and receding directions to a discharge port surface of the recording means for covering the discharge port surface, a wiper sliding while contacting with the discharge port surface to wipe the discharge port surface to clean it, a wiper driving gear for transferring drive to the wiper, a cam and gear



member equipped with a cam portion for controlling movement of the cap and a gear portion for transferring drive to the wiper driving gear, in which the cam and gear member is configured so that  
5 the gear portion engages with the wiper driving gear after the cap has moved to a position where the cap does not interfere with the wiper, both of capping operation and wiping operation can be controlled with the single cam and gear member, which makes it  
10 possible to miniaturize a recovery mechanism portion for keeping and recovering the ink discharging performance of the recording means. Thereby, an ink jet recording apparatus in which the recording apparatus body can be miniaturized is provided.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic perspective view showing an embodiment of an ink jet recording apparatus to which the present invention is applied;

20 FIG. 2 is a partial perspective view showing the structure of an ink discharge portion of recording means in FIG. 1;

FIG. 3 is a schematic perspective view showing the configuration of a first embodiment of a recovery  
25 mechanism portion of the ink jet recording apparatus to which the present invention is applied;

FIG. 4 is a schematic side view showing a cap

driving portion of the recovery mechanism portion of FIG. 3;

FIG. 5 is a schematic front view showing a cam and gear member in FIGS. 3 and 4;

5        FIG. 6 is a side view of the cam and gear member in FIG. 5;

FIG. 7 is a front view showing the cap driving portion and a wiper driving portion of the recovery mechanism portion of FIG. 3 in a state at the time of  
10 the capping of a recording head;

FIG. 8 is a front view showing the cap driving portion and the wiper driving portion of FIG. 7 in a state at the time of separating the cap;

FIG. 9 is an exploded perspective view showing  
15 the configuration of a cam and gear member in a second embodiment of the recovery mechanism portion of the ink jet recording apparatus to which the present invention is applied;

FIG. 10 is a schematic perspective view showing  
20 a third embodiment of the recovery mechanism portion of the ink jet recording apparatus to which the present invention is applied; and

FIG. 11 is a schematic front view of a cam and gear member in a fourth embodiment of the recovery  
25 mechanism portion of the ink jet recording apparatus to which the present invention is applied.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, the attached drawings are referred to while the preferred embodiments of the present invention are concretely described.

5 Incidentally, the same reference numerals designate the same or corresponding components all through the drawings.

(First Embodiment)

FIG. 1 is a schematic perspective view showing  
10 an embodiment of an ink jet recording apparatus to which the present invention is applied. In FIG. 1, the ink jet recording apparatus is provided with a paper feeding portion 1 for feeding a recording material such as recording paper to a recording  
15 position, a paper conveying portion 2 for conveying the recording material, a carriage 4 for moving (performing main scanning) along the recording material while mounting a recording head 3 as recording means thereon, and a recovery mechanism  
20 portion 5 for keeping and recovering the ink discharge performance of the recording head 3 appropriately. The carriage 4 is supported to be guided by a guide shaft 6 in a state capable of moving reciprocally. The carriage 4 is driven to  
25 move in the directions of a two-directional arrow A in FIG. 1 by a carriage motor 7 as a driving source.

As it will be described later, the recovery

mechanism portion 5 is provided with capping means for protecting an ink discharge portion of the recording head 3 during the time when recording is not performed, wiping means for wiping the ink  
5 discharge portion (a discharge port surface) to clean it, sucking means for sucking ink from discharge ports in the state of capping the ink discharge portion, and the like. The recording head 3 as the recording means is ink jet recording means for  
10 discharging ink by means of thermal energy. The recording head 3 is equipped with electrothermal conversion members for generating the thermal energy. Moreover, the recording head 3 generates film boiling in ink by means of the thermal energy applied by the  
15 electrothermal conversion members to discharge the ink from the discharge ports by means of the pressure changes owing to the growth and shrinkage of air bubbles generated by the film boiling. Thereby, the recording head 3 performs recording (printing).

20       FIG. 2 is a partial perspective view showing the structure of the ink discharge portion of the recording head 3 schematically. In FIG. 2, a discharge port train composed of a plurality of discharge ports 82 arranged at a predetermined pitch  
25 is formed on a discharge port surface 81 opposed to a recording material (a recording medium) such as recording paper or the like with a predetermined gap

(e.g. about 0.2 mm to about 2.0 mm). Electrothermal conversion members (such as heat elements or the like) 85 for generating energy for discharging ink are distributed along the wall surfaces of respective liquid paths 84 making the respective discharge ports 82 communicate with a common liquid chamber 83. The recording head 3 is mounted on the carriage 4 in a positional relationship in which the plural discharge ports 82 are arranged in a direction crossing with the main scanning direction (the moving direction of the recording head 3). Thus, the recording head (recording means) 3 is configured to discharge ink from the discharge ports 82 by means of the pressure generated at the time of the film boiling of the ink in the liquid paths 84 caused by the driving (current carrying) of the corresponding electrothermal conversion members 85 on the basis of an image signal or a discharge signal.

FIG. 3 is a schematic perspective view showing the structure of a first embodiment of the recovery mechanism portion 5 to which the present invention is applied. FIG. 4 is a schematic side view showing a cap driving portion of the recovery mechanism portion 5 of FIG. 3. In FIG. 3, the recovery mechanism portion 5 is composed of capping means (a cap portion) 20, wiping means (a wiper portion) 30 and sucking means (a suction pump portion) 40 as recovery

means. These pieces of the recovery means are disposed on a base portion 10 of the recovery mechanism portion 5. The two-directional arrow A in FIG. 3 indicates the moving directions of the carriage 4 mounting the recording head 3 thereon.

In FIGS. 3 and 4, a reference numeral 21 designates a cap made of an elastic material such as rubber, an elastomer or the like for sealing the discharge port surface 81 of the recording head 3 hermetically. Moreover, the cap 21 is attached to a cap holder 22 being a rigid member, and is configured to adhere to the discharge port surface 81 of the recording head 3 when no recording is performed, or when a suction recovery is performed. The cap 21 includes an ink sucking port 21a and an air communication port 21b. The ink sucking port 21a is connected to a suction pump 41. The air communication port 21b communicates with the air. Incidentally, the air communication port 21b is opened or closed with an air communication port opening/closing lever (not shown).

Moreover, a cap absorber (not shown) is housed in the cap 21. The cap absorber is disposed to be opposed to the discharge port surface 81 of the recording head 3 with a predetermined gap between them at the time of capping. The cap holder 22 is attached in a state capable of being translated (into

the vertical direction in the example shown in FIG.  
3) along guide grooves 11a and 11b (one guide groove  
11b is not shown) equipped on the base portion 10.  
The cap holder 22 is urged toward the recording head  
5 3 by a cap spring 23 (shown in FIG. 4) mounted  
between the base portion 10 and the cap holder 22.

When the cap 21 is separated from the discharge  
port surface 81 of the recording head 3 (when the cap  
21 is lowered in the example shown in the figures),  
10 the cap holder 22 is pressed toward a direction to be  
distant from the discharge port surface 81 (the cap  
holder 22 is pushed down in the example shown in the  
figures) by a lever member (a cap lever) 24 to move  
the cap 21. The cap lever 24 as the lever member is  
15 attached to be rotatable around a shaft center 24a  
(shown in FIG. 4) provided on the base portion 10 of  
the recovery mechanism portion 5. An end portion (a  
cam surface abutting portion) 24b of the cap lever 24  
moves along the curved surface of a cam portion (a  
20 peripheral surface cam) of a cam and gear member 12,  
which is driven to rotate. That is, a position of  
the cap 21 to the recording head 3 (a position in an  
approaching or receding direction) is determined on  
the basis of a rotation position of the lever member  
25 (the cap lever) 24 based on a driven rotation  
position of the cam and gear member 12.

In FIG. 3, a wiper 31 for wiping and cleaning

(cleaning) the discharge port surface 81 of the recording head 3 is attached to a wiper holder 32. A lead screw 33 is rotatably pivoted on the base portion 10. The lead screw 33 is inserted into an end portion of the wiper holder 32, and the other end portion of the wiper holder 32 on the opposite side of the lead screw 33 is fitted to a guide portion (a rail or a groove formed on the base portion 10) 34. The guide portion 34 is formed in parallel to the discharge port train formed on the discharge port surface 81 of the recording head 3 together with the lead screw 33. A protruding portion (not shown) of the wiper holder 32 is engaged with a groove formed in a spiral on the surface of the lead screw 33. Consequently, when the lead screw 33 rotates, the wiper holder 32 is translated into the arrangement direction of the discharge port train. Accompanying the translation of the wiper holder 32, the wiper 31 slides to rub the discharge port surface 81 of the recording head 3, and wipes a section including the discharge port train to clean it (performs wiping off cleaning thereof).

In the present embodiment, the wiping and cleaning of the discharge port surface 81 is performed in the direction of the wiper 31 moving from the rear of the recoding apparatus body (the inner side in FIG. 3) to the front (into the



direction of an arrow B in FIG. 3). After the wiper 31 has passed through the discharge port surface 81, the wiper 31 abuts a wiper cleaner (not shown) to remove the ink or the foreign matter which is  
5 attached to the wiper 31. With regard to the wiper 31, the present embodiment is configured as described above. A wiper driving gear 36 is fixed to an end portion of the lead screw 33. On the other hand, the cam and gear member 12 is rotatably pivoted on the  
10 base portion 10. A cam portion 12a and a gear portion 12b are formed on the cam and gear member 12. The gear portion 12b is composed of a portion including a no tooth portion 12c and a portion not including any no tooth portion (a gear portion on all  
15 over the periphery).

The portion including the no tooth portion 12c of the gear portion 12b is disposed to be able to engage with the wiper driving gear 36, and the portion not including any no tooth portion of the  
20 gear portion 12b is always engaged with a driving gear 13. Thus, the embodiment is configured to transfer drive for rotating the lead screw 33 to the wiper driving gear 36 through the cam and gear member 12. Hereupon, an idler gear (not shown) may be  
25 provided between the gear portion 12b of the cam and gear member 12 and the wiper driving gear 36 for adjusting the moving speed of the wiper 31, or the

rotation speed of the lead screw 33.

FIG. 5 is a schematic front view of the cam and gear member 12 of FIGS. 3 and 4, and FIG. 6 is a side view of the cam and gear member 12 of FIG. 5. In  
5 FIGS. 3 to 6, the cam and gear member 12 is provided with the cam portion 12a for driving the cap 21 in an approaching or receding direction against the recording head 3, and the gear portion 12b for  
10 transferring the drive to the wiper driving gear 36 to make the wiper 31 operate. The cam and gear member 12 is rotatably pivoted on the base portion 10 of the recovery mechanism portion 5. On the cam  
portion 12a are formed a wiping section (a section corresponding to the no tooth portion 12c of the gear  
15 portion 12b, which will be described later) for making the wiper 31 operate when the cap 21 is at a position where the cap 21 is most distant from the recording head 3 (the most retracted position  
corresponding to the lowest point in the example  
20 shown in the figures), a cap forward/backward driven section for making the cap 21 move in the approaching or receding direction against the recording head 3, and a capping section for making the cap 21 adhere  
25 closely to the discharge port surface 81 of the recording head 3.

A portion for opening the air communication port 21b of the cap 21 by means of an air communication

port opening/closing lever (not shown) is formed in the scope of the capping section. A no tooth section is formed in a part of the gear portion engaging with the wiper driving gear 36 of the gear portion 12b for  
5 limiting the drive to be transferred to the wiper driving gear 36 only when the cam and gear member 12 is in the wiping section (an angle range for wiping). In FIG. 3, the reference numeral 41 designates the suction pump, which is connected with a tube joint  
10 portion 22c of the cap holder 22 through a tube 42, and which is further led to the inside of the cap 21 through the ink sucking port 21a. Consequently, by making the suction pump 41 operate in the state of covering the discharge port surface 81 with the cap  
15 21 (a capping state), it is possible to generate a negative pressure in the cap 21. As the suction pump 41, for example, a tube pump, a cylinder pump or the like is used.

FIG. 7 is a front view showing the cap driving  
20 portion and a wiper driving portion of the recovery mechanism portion 5 of FIG. 3 in a state at the time of the capping of the recording head 3. FIG. 8 is a front view showing the cap driving portion and the wiper driving portion of FIG. 7 in a state at the  
25 time of separating the cap 21. Next, FIGS. 7 and 8 are referred to while approaching or receding operation of the cap 21 and sliding and contacting

operation (forward/backward moving operation) of the wiper 31 are described. The driving gear 13 is rotated by a driving source (not shown) such as a recovery system motor or the like, and the cam and gear member 12 is in turn rotated through the driving gear 13. Then, the end portion 24b (the cam surface abutting portion) of the cap lever 24 moves in accordance with the movement (rotation) of the cam portion 12a, and the cap lever 24 rotates. In the example shown in the figures, when the cam and gear portion 12 rotates clockwise, the cap lever (the lever member) 24 rotates counterclockwise around the shaft (the shaft center) 24a thereof in the figures.

When the cap lever 24 as the lever member rotates counterclockwise as shown in the figures, surfaces 24d and 24e (abutting portions; the not shown surface 24e is formed on the side opposite to the surface 24d) of the cap lever 24 push down boss portions 22d and 22e of the cap holder 22. Thereby, the cap 21 moves to the direction receding from the recording head 3. Incidentally, a predetermined area of the gear portion 12b for transferring the drive to the wiper driving gear 36 is formed to be the no tooth portion. Consequently, when the cap 21 is at the capping position and when the cap 21 is moving in the approaching or the receding direction, the drive is not transferred to the wiper driving gear 36.

Therefore, the wiper 31 is staying at a waiting position (a retracting position or a home position) distant from the recording head 3.

When the cap lever 24 has further rotated  
5 counterclockwise shown in the figures so that the cap 21 has reached the most distant position from the recording head 3 (the lowest position in the example shown in the figures), the gear portion 12b of the cam and gear member 12 begins to engage with the  
10 wiper driving gear 36. When the cam and gear member 12 is further rotated, a driving force is transferred to the lead screw 33 through the wiper driving gear 36. Then, the lead screw 33 rotates to move the wiper 31 into the direction of the arrow B in FIG. 3  
15 (the direction from the rear to the front of the recording apparatus). The movement of the wiper 31 makes the end portion of the wiper 31 slide to contact with (slide to rub) the discharge port surface 81 of the recording head 3 to execute the  
20 wiping and cleaning (the wiping off cleaning) of the discharge port surface 81. Then, the wiper 31 passes through the discharge port surface 81 to move up to a predetermined position on the opposite side (the front of the recording apparatus).

25 In this state, when the cam and gear member 12 is rotated counterclockwise as shown in the figures by rotating the driving source (not shown) such as

the recovery system motor or the like inversely, the lead screw 33 is inversely rotated, and the wiper 31 first moves into a returning direction (a direction from the front to the rear of the recording apparatus in the example shown in the figures). After that, the end portion 24b of the cap lever 24 moves along the cap portion 12a, and thereby the cap lever 24 rotates clockwise in the figures to be separated from the boss portions 22d and 22e of the cap holder 22. Consequently, the cap 21 and the cap holder 22 is urged toward the recording head 3 by the spring force of the cap spring 23, so that the cap 21 adheres closely to the discharge port surface 81 of the recording head 3. Thereby the discharge ports 82 are shut tightly (are capped).

A tooth form 24c as stopper means is provided on the cap lever 24 as the lever means as shown in FIGS. 7 and 8. When the wiper driving gear 36 is opposed to the no tooth portion 12c of the gear portion 12b of the cam and gear member 12 so that no drive is transferred to the wiper driving gear 36, the tooth form 24c is engaged with the wiper driving gear 36 as shown in FIG. 7, and the tooth form 24c functions as the stopper means for preventing the unnecessary movement of the wiper driving gear 36. Then, when the cap lever 24 has rotated until the cap 21 has reached the most distant position from the discharge

port surface 81 of the recording head 3 (the most retracted position or the lowest position in the figures) (when the cap lever 24 has become the state in FIG. 8), the engagement of the tooth form 24c with the wiper driving gear 36 is broken off and the wiper driving gear 36 becomes the rotatable state.

(Second Embodiment)

FIG. 9 is an exploded perspective view showing the configuration of a cam and gear member 12 in a second embodiment of the recovery mechanism portion 5 of the ink jet recording apparatus to which the present invention is applied. In the cam and gear member 12 of the first embodiment described above, the cam portion (the cam portion driving the cap 21) 12a and the gear portion (the gear portion transmitting drive to the wiper driving gear 36) 12b are integrally formed to be a member. However, the cam and gear member 12 in the present embodiment is formed to be the cam portion 12a and the gear portion 12b being individual parts 14 and 15. Then, a shaft 16 is inserted into the individual parts 14 and 15 with a pressure to assemble them to rotate at the same phase. Thus, the individual parts 14 and 15 are integrally configured. The cam and gear member 12 integrated in the above-mentioned way is rotatably mounted on the base portion 10 of the recovery mechanism portion 5 together with the shaft 16.

Incidentally, the example shown in FIG. 9 is configured to rotate the cam 14 (the cam portion 12a) and the gear 15 (the gear portion 12b) at the same phase. That is, a hole having the cross section of a letter D is formed in the centers of the cam 14 and the gear 15 which are made to be separate components. Then, the shaft 16 having the same D-shaped cross section is pressed to be inserted into the D-shaped holes. The present embodiment differs from the first embodiment described above in the matter described above. However, the other portions of the present embodiment are configured to be substantially the same as those of the first embodiment.

(Third Embodiment)

FIG. 10 is a schematic perspective view showing a third embodiment of the recovery mechanism portion of the ink jet recording apparatus to which the present invention is applied. In the first embodiment described above, the tooth form 24c formed integrally with the cap lever 24 as the stopper means for preventing the movement (rotation) of the wiper driving gear 36 when no drive is transferred to the wiper driving gear 36 is used. However, the present embodiment uses a click claw 17 capable of being elastically displaced which is formed integrally with the base portion 10 of the recovery mechanism portion in place of the tooth form 24c. The click claw 17



includes a claw portion to engage with a side face of the wiper holder 32, and the click claw 17 is formed to hold the wiper holder 32 at the waiting position (shown in FIG. 10) with an elastic force removably by  
5 engaging the claw portion with the side face of the wiper holder 32. Moreover, the click claw 17 may be configured not to be integral with the base portion 10, but to be fixed at a predetermined position as an individual member capable of being elastically  
10 displaced. Although the present embodiment is different from each of the embodiments described above in the matter described above, the other components of the present embodiment are substantially the same as those of the embodiments  
15 described above. The corresponding components are designated by the same reference numerals as those of the preceding embodiments, and the detailed description of the components is omitted.

(Fourth Embodiment)

20 FIG. 11 is a schematic front view of a cam and gear member 12 in a fourth embodiment of the recovery mechanism portion 5 of the ink jet recording apparatus to which the present invention is applied. Each of the embodiment described above adopts the  
25 configuration in which the cam and gear member 12 is made to be rotatable in both of the forward and the backward directions, and in which only a one-way lead

groove is formed on the lead screw 33. However, when the cam and gear member 12 can be formed by the use of a member having a relatively large diameter, or when the driving stroke (a necessary movement distance) of the wiper 31 may be relatively short, the cam and gear member 12 may be configured as follows. That is, the configuration of the cam and gear member 12 is shaped to include a wiper forward driven section and a wiper backward driven section which are symmetrically arranged, and a cap backward driven section and a cap forward driven section which are symmetrically arranged, as a fourth embodiment shown in FIG. 11. Furthermore, a series of lead groove (a series of guide groove) which makes it possible to move the recovery mechanism 5 reciprocally by rotations of the lead screw 33 in one direction is formed on the lead screw 33. Thereby, the capping operation and the wiping operation can be performed by the use of only the rotations of the driving source (not shown) such as the recovery system motor or the like in one direction.

Incidentally, in the embodiments described above, a serial type ink jet recording apparatus performing recording operation while moving the recording head 3 as the recording means into the main scanning direction is exemplified to be described. However, the present invention can be similarly

applied to a line type ink jet recording apparatus performing recording by executing only sub-scanning by the use of a line type ink jet head having the length covering the all of the width or a part of the width of a recording material. Similar advantages can be obtained also by the line type ink jet recording apparatus. Moreover, the present invention can be freely implemented regardless of the number of recording heads. In addition to an ink jet recording apparatus using one recording head, the present invention can be similarly applied to a color recording ink jet recording apparatus using a plurality of recording heads using different kinds of color inks, a gradation recording ink jet recording apparatus using a plurality of recording head using the inks having the same color and different densities, and an ink jet recording apparatus made by combining the ink jet recording apparatuses described above. In such ink jet recording apparatuses, similar advantages can be obtained.

Moreover, the present invention can be similarly applied to any configurations of the arrangements of a recording head and an ink tank such as a configuration using an exchangeable head cartridge composed of a recording head and an ink tank which are integrated to be one body, a configuration using an individual recording head and an individual ink

tank which are connected to each other with an ink feeding tube or the like, and the like. In such cases, the similar advantages are also obtained. Incidentally, the present invention can be applied to, 5 for example, an ink jet recording apparatus using an electromechanical transducer such as a piezoelectric element or the like. However, among all, the present invention can obtain superior advantages when the invention is applied to an ink jet recording 10 apparatus using an ink jet recording head of the system of discharging ink by means of thermal energy, because recording (printing) which is made to be a high density and highly fine can be realized by a such type ink jet recording head.

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